

NOTE

Decibel Tables

By K. S. JOHNSON

ABOUT twenty years ago, Bell System communication engineers felt the need for, and adopted, a new "Transmission Unit," initially abbreviated "TU" but some five years later given the name "Decibel," or db. This unit is now universally used throughout the communication world and is fundamentally a measure of the ratio of any two powers. Quantitatively, the number of decibels corresponding to the ratio of any two powers is 10 times the common logarithm of that ratio.* If the ratio of the first power to the second power is greater than unity, the first power is said to represent a transmission "gain" with respect to the second power, or the latter is said to represent a "loss" with respect to the first power.

Since currents flowing through, or voltages impressed across, the same or equal impedances will result in powers that are proportional to the squares of these currents or voltages, it is possible, under these specific conditions, to state that the number of decibels corresponding to the ratio of any two such currents or voltages is 20 times the common logarithm of the absolute magnitude of the ratio of these currents or voltages.

Another unit that is frequently employed in theoretical transmission problems is the "Neper." The use of this unit often results in the simplification of such problems and, hence, its relationship to the decibel and to exponential and hyperbolic functions is frequently of interest to communication engineers.

Although the relations between these various values are obviously not complicated ones, it has been found by experience that tables of numerical values are often very useful to communication engineers. As a result, rather extended tables (21 pages) have been computed under the direction of the writer and P. H. Richardson, in which the entering arguments are: (1) decibels, with the tabular values giving the corresponding current, voltage, or power ratios—and their reciprocals; (2) current or voltage ratios, with the tabular values being the corresponding decibels. Tables (16 pages) have also been computed in which the entering arguments are decibels and the corresponding tabular values are nepers (A), e^A , e^{-A} , $\sinh A$, $\cosh A$ and $\tanh A$. These latter tables are, among other things, useful in the design of attenuators or pads, etc.

Photo offset copies of any of the above tables may be obtained gratis from the Director of Publication of the Bell Telephone Laboratories, Inc., 463 West Street, New York 14, N. Y.

* See "Decibel—The Name for the Transmission Unit", by W. H. Martin, *Bell Sys. Tech. Jour.*, January 1929.